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ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTION OF PROBLEM.

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43. Proposed by F. M. SHIELDS, Coopwood, Mississippi.

Four men, A, B, C, and D, start from the same place, the traveling rates of A and C are equal, and the traveling rates of B and D were as 17 to 18, respectively; B could travel one mile in 7 minutes and 12 seconds. A traveled *due* west a certain distance, B traveled *due* north the cube of A's distance *plus* his distanc; C traveled *due* east a certain distance, and D traveled *due* south the cube of C's distance *plus* his distance: They all change directions, and A traveled *due* north a certain distance, B traveled *due* east the 5th power of A's distance north; C traveled *due* south a certain distance, and D traveled *due* west the 5th power of C's distance south,—when it was found that the sum of the north and south distances traveled by B and D was 351090 feet, and the sum of the distances that B and D traveled east and west was 5939200000 feet, and that the product of the distances that A and C traveled east and west *plus* the square of the difference of these distances, *plus one* was 3901; and that the product of the distances that A and C traveled north and south *plus* the square of the difference *squared*, plus the product multiplied by the square of the difference, was 49410000 [equal to the following new formulas: $(nn+d^2+1)=3901$, and $\{(nn+d^2)^2+(nn\times d^2)\}=49410000$]. How far on a line is each party from the starting place, and how long did it require for B and D each to make the entire trip from starting place to the end ?

Solution by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Let x=distance A travels due west
y= " C " " east
z= " A " " north
u= " C " " south.

Then x^3+x=distance B travels due north
y^3+y= " D " " south
z^5= " B " " east
u^5= " D " " west

Also $x^3+y^3+x+y=351090$......(1)
$z^5+u^5=5929200000$......(2)
$xy+(x-y)^2+1=3901$......(3)
$\{zu+(z-u)^2\}^2+zu(z-u)^2=49410000$......(4)

From (3), $x^2-xy+y^2+1=3901$......(5)
From (1), $(x+y)(x^2-xy+y^2+1)=351090$......(6)
(5) in (6) gives, $x+y=90$......(7)
(7) in (1) gives, $x^3+y^3=351000$......(8)
(7) cubed minus (8) gives, $3xy(x+y)=378000$......(9)
(7) in (9) gives, $xy=1400$......(10)

From (7) and (10), $x=70$ or 20, $y=20$ or 70
From (2), $(z+u)(z^4-z^3u+z^2u^2-zu^3+u^4)=5929200000$......(11)
From (4), $z^4-z^3u+z^2u^2-zu^3+u^4=49410000$......(12)

(12) in (11) gives, $z+u=120$......(13)

$[\{(13)\}^5-(2)]\div5$ gives, $zu(z^3+2z^2u+2zu^2+u^3)=3790800000$......(14)

$\{(13)\}^3$ in (14) gives $zu(1728000-z^2u-zu^2)=3790800000$......(15)

(13) in (15), after reduction, gives, $z^2u^2-14400zu=-31590000$

$\therefore zu=11700$ or 2700......(16).

From (13) and (16) we get, $z-u=\pm60$ or $\pm180\sqrt{-1}$.

$\therefore z=90$ or 30 or $30(2\pm3\sqrt{-1})$,

$u=30$ or 90 or $30(2\mp3\sqrt{-1})$.

A is distant from the starting point either of the following:—

$\sqrt{90^2+70^2}=114.017+$feet, $\sqrt{90^2+20^2}=92.196$ feet.

$\sqrt{30^2+70^2}=76.157$ feet, $\sqrt{30^2+20^2}=36.055$ feet.

C is distant from the starting point either of the following:—

36.055 feet, 76.157 feet, 92.196 feet, 114.017 feet.

B is distant from the starting point either of the following:—

$\sqrt{(70^3+70)^2+(90^5)^2}=5904900009.965$ feet,

$\sqrt{(20^3+20)^2+(90^5)^2}=5904900000.005$ feet,

$\sqrt{(70^3+70)^2+(30)^{10}}=24302421.629$ feet,

$\sqrt{(20^3+20)^2+(30)^{10}}=24300001.323$ feet.

D is distant from the starting point either of the following:—

24300001.323 feet, 24302421.629 feet, 5904900000.005 feet, 5904900009.965 feet.

B has traveled either of the following distances:

$70^3+70+90^5=5905243070$ feet$=118417.38447$ miles,

$20^3+20+90^5=5904908020$ feet$=118353.79167$ miles,

$70^3+70=30^5=24643070$ feet$=4667.24811$ miles,

$20^3+20+30^5=24308020$ feet$=4603.79167$ miles.

D has traveled either of the following distances:—

4603.79167 miles, 4667.24811 miles, 118353.79167 miles, 118417.38447 miles.

B travels 1 mile in 7 min. 12 sec.$=432$ sec.

D travels one mile in $\frac{17}{18}$ of $432=408$ sec.

It has taken *B* either of the following times:—

$118417.38447\times432=51156310.09$ sec.$=14210$ h. 5 m. 10.09 sec.,

$118353.79167\times432=51128838$ sec.$=14202$ h. 27 m. 18 sec.,

$4667.24811\times432=2016251.18$ sec.$=560$ h. 4 m. 11.18 sec.,

$4603.79167\times432=1988838$ sec.$=552$ h. 27 m. 18 sec.

It has taken *D* either of the following times:—

$4603.79167\times408=1878347$ sec.$=521$ h. 45 m. 47 sec.,

$4667.24811\times408=1904237.22$ sec$=528$ h. 57 m. 17.22 sec.,

$118353.79167\times408=48288347$ sec.$=13413$ h. 25 m. 47 sec.,

$118417.38447\times408=48314292.86$ sec.$=13420$ h. 38 m. 12.86 sec.

The imaginary results have been omitted as impossible.

The above solution was the first received and entitles *Prof. ZERR* to the St. Andrews, Fla., City Lot, offered by the *PROPOSER*. Excellent solutions of later date were received from *H. C. WHITAKER*, *M. A. GRUBER*, *H. W. DRAUGHON*, *H. C. WILKES*, *A. H. BELL*, *A. L. FOOTE*, *A. H. HOLMES*, and *P. S. BERG*.